

Importance of landscape feature of an express highway facilities

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ABSTRACT

Expressway facility needs to be designed with considering not only function but its beauty. But all the facilities don't have to be considered the design side. Because each facility has a different part which is demanded design and a different rate of importance, so the pliability of design for the facility also has differences.

In this research, we propose fundamental data for producing a comfortable landscape feature in the expressway from the researches that we find a design pliability of each type of facilities through the design's legal standard, the design standard, and the present status analysis of the local expressway facilities, with questioning to the expressway user and study of the present status of the overseas expressway facilities, to deduce which facility has high pliability and need to be change of design.

INTRODUCTION

In the local express highway, there are many facilities which are necessary to a use. It has a various type and many installations, and each facility has different scales. As the express highway's function in Korea is transportation to the destination in a quick time, so the facilities were built by following the functional use and aesthetically it looks very dreary. And the facility which is established recently with a necessity as well as the preexisted have various features, that make the expressway look so complicated and disordered.

So the design of expressway facility needs to be designed with considering not only function but also its beauty. But all the facilities don't have to be considered the design side. Because each facility has a different part which is demanded design and a different rate of importance, so the pliability of design for the facility also has differences.

Therefore, in this research, we propose fundamental data for producing a comfortable landscape feature in the expressway from the researches that we find a design pliability of each type of facilities through the design's legal standard, the design standard, and

the present status analysis of the local expressway facilities, with questioning to the expressway user and study of the present status of the overseas expressway facilities, to deduce which facility has high pliability and need to be change of design.

2. Facilities and the routes in the local expressway for research

2-1. Objects for expressway facilities research

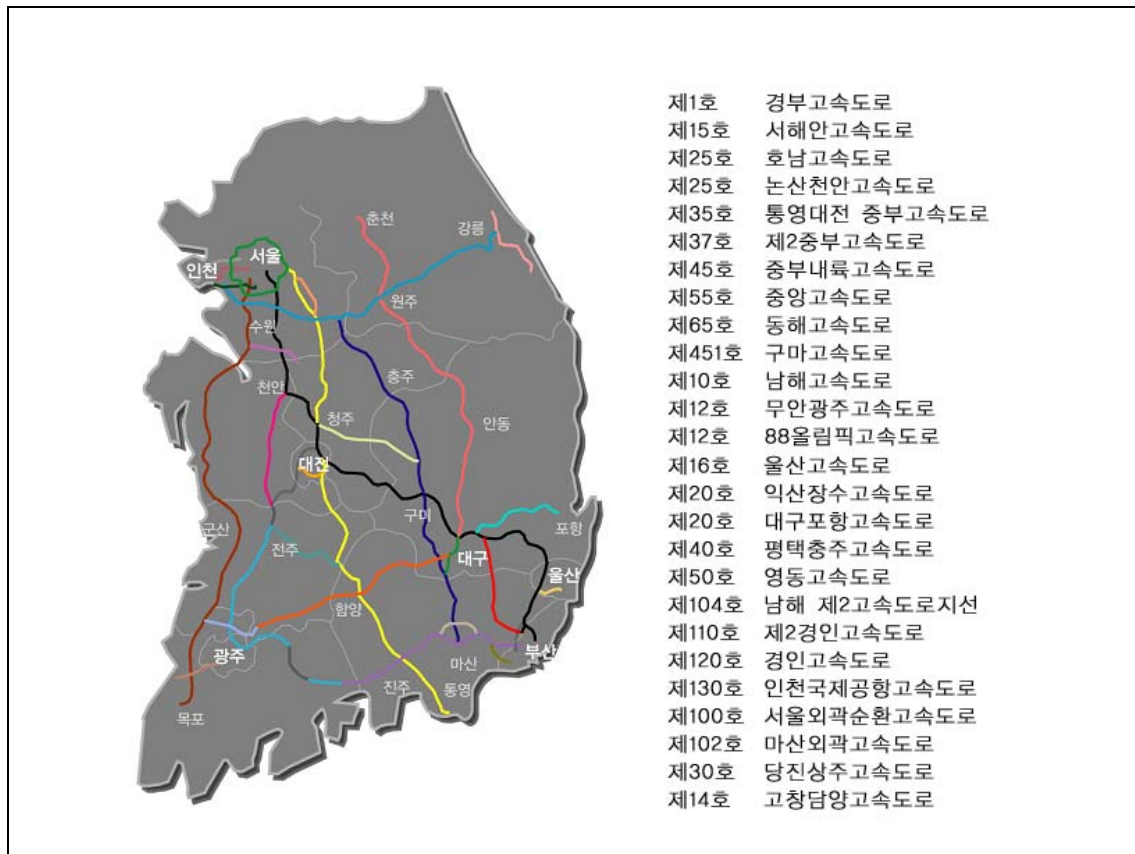
We classify the sort of facility in the local expressway from <Road Plan 2002, a standard chart of facility by Korea Expressway Corporation>, as follows: Engineering works structure, Subsidiary facilities, Safety facilities for managing traffic, Protecting safety facilities, visual safety facilities, The other safety facilities, etc. All those facilities are 25 kinds. And for research out of those is 21 kinds as a bridge, a tunnel, pavement of a road, a median strip, tall gate, place of business, a resting place, soundproofing walls, cutting slope, bus stop, emergency parking area, emergency liaison establishment, traffic safety sign, a road sign, a road surface mark, a road lightning sign, speed sensor, an advanced operation facilities, a protection fence, impact absorption facility, sight line induction facility, lighting facilities, slip control facility, facilities for a falling rock prevention, a temporary facilities, except the facility which has low pliability like, a road safety sign, a road lightning sign, speed sensor, emergency parking area.

<Chart1.The sort of expressway facility>

structure	bridge, tunnel, pavement of a road, median strip
subsidiary facilities	Toll Gate, place of business, resting place, soundproofing walls, cutting slope, bus stop, emergency parking, emergency liaison establishment
traffic management safety facilities	Traffic safety post, road sign, the road surface mark, road signal post, speed sensing, high technology operation facility
Safety facilities	protection a fence, impact absorption facility
sight increase Safety facilities	sight line induction facility, lighting facility
etc	slip control facility, Falling rocks prevention, temporary facities

2-2. Routes for expressway facility research

The route of the local expressway facility is 27 routes down for investigation which has opened currently to 31 may 2008.



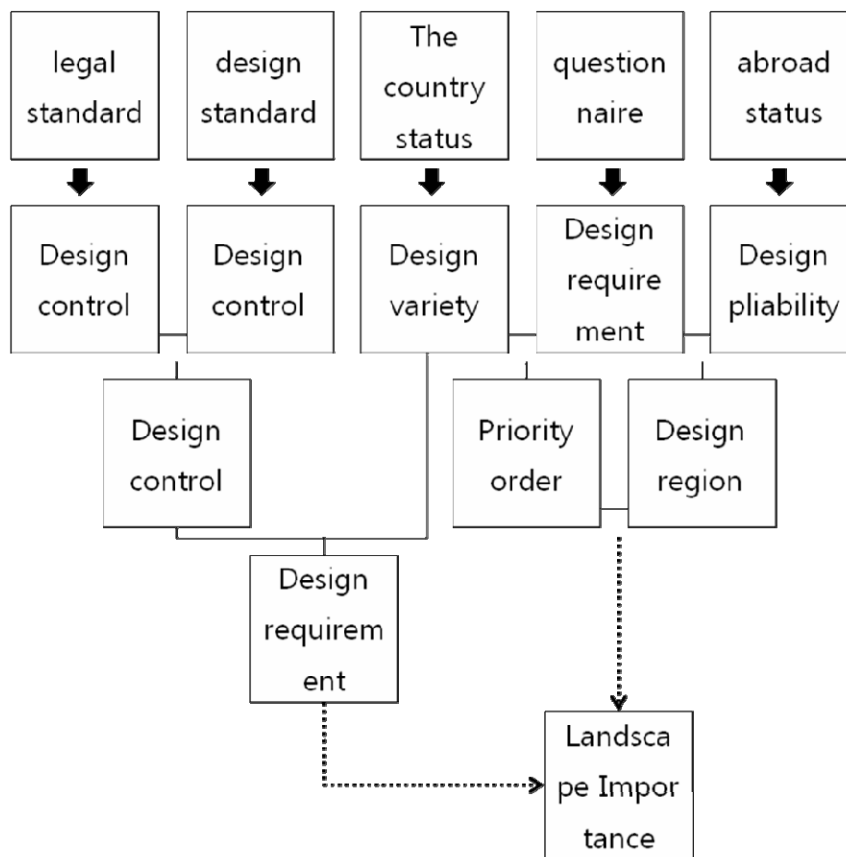
<Image1.The local expressway for research>

2-3. Methods for research of expressway facility's importance

Based on research of expressway facility in Korea, the flexibility of the design differences and analyzing parts that has the need of design, establish the theoretical range and elements. To understand the visual importance, the research went through these steps.

First, understand the legal standards, second, understand the lay out standards, third analyze the present state of installation design, fifth, and analyze highway installations of other countries. Deduce which facility has high pliability and need to be change of design from the researches that we find a design pliability of each type of facilities Moreover, through the analysis of these legal standards, domestic questionnaires, and domestic present state correlation it can be condensed like the following.

First, laws, regulation, systems, guides and standards are graded by comparing legal and lay out principles. Second, analyze the legal and lay put principles and understand the relation between existing facilities. Third, through the questionnaires understand the priority ranking of future design. Forth, compare domestic and other country's' high priority ranged designed facility.



3. Domestic expressway facility's legal standards and flexibility of design

Depending on the facility there are installations that have various types of design possibilities and there are that has many limitations. By analyzing the facility and legal standards extract the installations that have the design possibilities and understand the range of that can be designed.

Laws of expressway facility are Law of express highway, Law of traffic safety, Enforcement ordinance and regulations of traffic safety-law, Road traffic law, The road law, Road legal enforcement regulation, Road legal Enforcement Ordinance, The toll road law, Toll road legal enforcement regulation and toll road legal Enforcement Ordinance, The law and enforcement regulation of Korea expressway corporation.

The research method is to grade the 24 types of facility into three ratings; high (1), medium (2), low (3), by form, material, and color through the numbers of legal standards and intensity. Installations that don't have any legal limitations, according to the design flexibility, receive a high score (3). Installations that have several limitations are granted with a low score. The higher the score the more flexible the design can be and the lower less flexible design it can have.

The outcome is toll-gates, stores, resting area, bus stops are design flexible but pavement of a road, road signs, road condition signs, slip prevention installation are not design flexible.

<Chart 2.The analysis of design by legal standard for local expressway facility>

facilities	form	material	color	total
Toll Gate	3	3	3	9
place of business	3	3	3	9
resting place	3	3	3	9
bridge	2	1	3	6
tunnel	1	1	3	5
cutting slope	1	2	2	5
soundproofing walls	2	1	2	5
median strip	1	1	3	5
pavement of a road	1	1	1	3
road sign	1	1	1	3
lighting	2	1	1	4
bus stop	2	3	3	9
emergency liaison establishment	2	2	1	5
the road surface mark	1	1	1	3
high technology operation facility	1	2	2	5
protection a fence	1	1	2	5
impact absorption facility	2	1	1	4
sight line induction facility	1	2	1	4
slip control facility	1	1	1	3
Falling rocks prevention	1	1	2	4
temporary facilities	2	2	2	6

4. Study of the design standard for local express facility

The domestic express highway facility is providing under referring the design standard by Ministry Of Land-Transport And Maritime Affairs and Korea Expressway Corporation. In the facility design standard, there are many facilities that we can design variously or have restriction. So we find which facilities have design possibility and a range that can be designed after analyzing of the research about the facility design standard.

The related guide and standard are The practical manual of traffic safety facility, The regulation of road sign, The guide of road administration, and The manual of road

design-2000.

The research method is to grade the 24 types of facility into three ratings; high (1), medium (2), low (3), by form, material, and color through the numbers of legal standards and intensity. From contents, the structure is to study a structural attribute and a production method which are applied in the facility, the material for material attribute and a production method, and the color for color attribute and a production method.

The outcome by design standard is toll-gates, place of business, resting area, bridge, tunnel, cutting slope, soundproofing walls, bus stops, the road surface mark, and a sight line induction facility have design flexible but the pavement of a road, road signs, emergency liaison establishment, slip prevention installation, and a temporary facility have not design flexible.

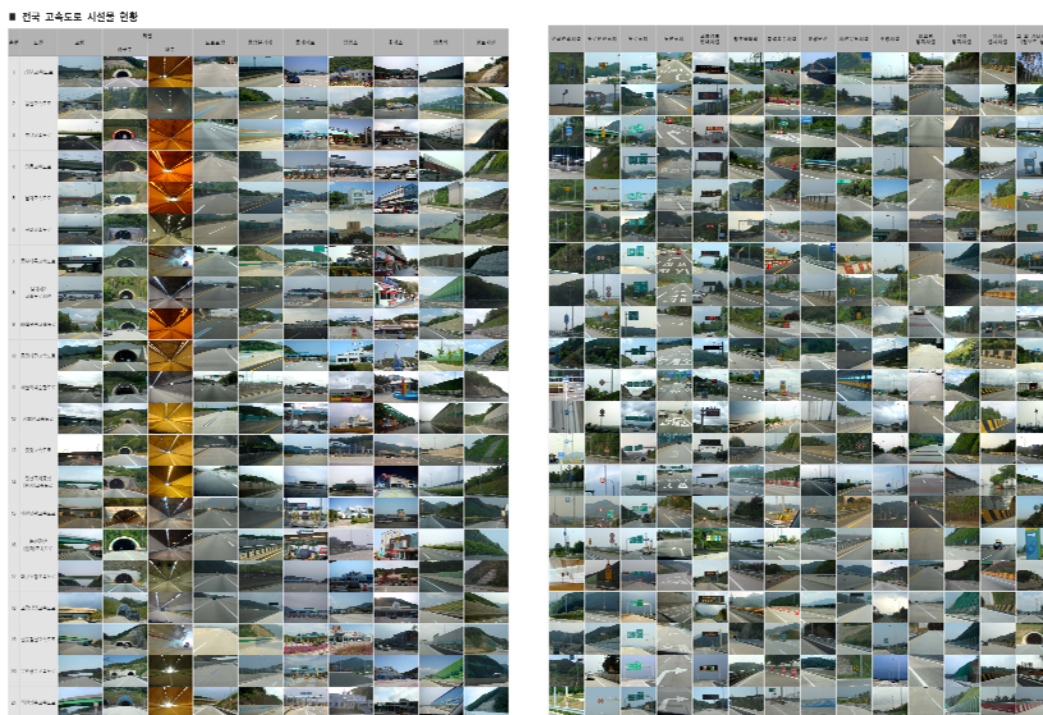
<Chart3.Design analysis by the Design Standard for local expressway facility>

facilities	form	material	color	total
Toll Gate	3	2	3	8
place of business	2	3	3	8
resting place	3	3	3	9
bridge	2	2	3	7
tunnel	1	1	3	5
cutting slope	1	2	3	6
soundproofing walls	2	2	3	7
median strip	1	1	3	5
pavement of a road	1	1	1	3
road sign	1	1	1	3
lighting	1	2	3	6
bus stop	3	2	3	8
emergency liaison establishment	2	2	2	6
the road surface mark	1	1	1	3
high technology operation facility	1	1	2	4
protection a fence	1	1	3	5
impact absorption facility	2	1	1	4
sight line induction facility	1	1	1	3
slip control facility	1	1	2	4
Falling rocks prevention	2	1	3	6
temporary facilities	3	3	3	9

5. Present design condition of local expressway facility

To study of the present design condition of local expressway facility, we made chart with choosing representative pictures for each facilities by taking pictures of 24 kind facilities in each facilities in the 27 local expressway routes. From those pictures, we made grade to understand differences of each facility's design by studying about its feature, material, and color. The evaluation method is that we checked the every different numbers of each facility's feature, material, and color, and analyzed the changeable range of design.

The outcome by present design condition is resting area, place of business, soundproofing walls, tunnel, bridge, median strip have design flexible but toll Gate, pavement of a road, lighting system, road surface mark, advanced operation facility, protection fence have rarely design flexible.



<Image1. Pictures of Present design condition of local expressway facility >

<Chart5.Analysis of Present design condition of local expressway facility>

facilities	form	material	color	total
Toll Gate	1	1	1	3
place of business	10	5	10	25
resting place	10	10	10	30
bridge	4	2	6	12
tunnel	1	5	10	16
cutting slope	2	3	2	7
soundproofing walls	4	6	10	20
median strip	3	2	5	10
pavement of a road	1	1	1	3
road sign	4	1	1	6
lighting	1	1	1	3
bus stop	3	3	2	8
emergency liaison establishment	2	1	2	5
the road surface mark	1	1	1	3
high technology operation facility	2	1	1	4
protection a fence	1	1	2	4
impact absorption facility	3	1	2	6
sight line induction facility	3	1	2	6
slip control facility	2	2	3	7
Falling rocks prevention	3	2	2	7
temporary facilities	2	2	2	6

6. Questionnaire for the expressway user as their using character.

We made up a question about the expressway facility to the expressway user for study of design priority. The questionnaire executed from 2st to 13st April 2009 to 530 people who is using frequently: 330 common people, 50 specialists, 150 staff of Korea Expressway Corporation. We asked the questions to common people at the resting area, and specialists and staff by e-mail

From question investigation, in order to find the interrelation of the facility and design, we set up the research list as follows. A facility symbolized the express highway, a facility needed design improvement urgently, and a facility demanded characteristic of structure or color and regional characteristic. The resting areas which executes a question investigation are Seoul meeting square rest area, Geumgang rest area, Manghyang rest area, Dong Seoul meeting square rest area, Heangdamdo rest area, Yoju rest area, the

ginseng land rest area, the Jungan rest area, Kosong rest area, Okgye rest area that is used much frequently from East, West, South, North, and including Sintanjin rest area which considers the truck driver in order not to be preponderated in location.

The result by questionnaire, the facilities which symbolize the express highway are in order of tall-gate, resting area, median strip. The facilities which require improvement of design urgently are in order of tall-gate, soundproofing walls, median strip, for demanding the feature differentiation are in order of tall-gate, rest area, soundproofing walls, median strip, and for color improvement are in order of soundproofing walls, median strip, tall-gate. And it appeared in order of tall-gate and rest area for a facility which is demanded design each area differently.

Synthetically, from the questioning, the facilities needed the change of design are in order of tall-gate, rest area, soundproofing walls, median strip, but lighting facility is not needed.

<Chart6.The priorities of facility design for express highway user>

facilities	form	material	color	total	facilities	form
Toll Gate	9	9	9	7	9	43
place of business	0	4	2	2	2	10
resting place	8	6	7	4	8	33
bridge	1	4	2	2	1	10
tunnel	1	6	2	2	1	12
cutting slope	0	5	2	2	1	10
soundproofing walls	0	8	5	9	2	24
median strip	2	8	5	8	1	24
pavement of a road						
road sign	1	6	2	3	1	12
lighting	0	4	2	1	1	8
bus stop						
emergency liaison establishment						
the road surface mark						
high technology operation facility						
protection a fence	0	8	2	1	1	12
impact absorption facility						
sight line induction facility						
slip control facility						
Falling rocks prevention						
temporary facilities						

7. Present design condition of overseas expressway facility

We studied the overseas expressway facilities in Japan, USA, France and Germany and took pictures of every facility for understanding the design pliability, and we made grade to understand differences of each facility's design by studying about its feature, material, and color from those pictures.

The evaluation method is to grade the facility into three ratings; high (1), medium (2), low (3), by feature, material, and color through the numbers of intensity.

The outcome by present design condition is in order of toll Gate, pavement of a road, place of business, bridge, impact absorption facility have design flexible. But the facility have rarely design flexible is in order of pavement of a road, bus stop, slip control facility.

<Chart7. Analysis of Present design condition of overseas expressway facility>

facilities	form	material	color	total
Toll Gate	3	3	3	9
place of business	2	3	3	8
resting place	3	3	1	7
bridge	3	2	3	8
tunnel	2	1	2	5
cutting slope	1	3	2	6
soundproofing walls	3	3	3	9
median strip	1	3	1	5
pavement of a road	1	1	1	3
road sign	2	1	1	4
lighting	2	1	1	4
bus stop	1	1	1	3
emergency liaison establishment	3	1	2	6
the road surface mark	2	1	1	4
high technology operation facility	3	1	2	6
protection a fence	1	1	2	4
impact absorption facility	3	2	3	8
sight line induction facility	3	1	2	6
slip control facility	1	1	1	3
Falling rocks prevention	1	1	2	4
temporary facities	1	1	2	4

8. Result and consideration

: Importance of landscape feature of an express highway facilities

To understand Importance of landscape feature of an express highway facilities, we study about the limit in compliance with a facility standard ,comparing the standard and present condition, and take the facility that have high design pliability and its part out of that. And by questionnaire, we find the priority order of the facility which demands a design and compare with overseas design to lead the direction of design.

The result which compares the restricted condition and a present condition of facility design, the facility which has high design pliability but with the fact that the design is not flexible are toll-gate, bus stop, and temporary establishment facility. And the facilities that have low design pliability for feature are toll-gate, tunnel, for material are toll-gate, bridge, place of business, bus stop, and for color is toll-gate.

Comparing the present condition of expressway facility with the questionnaire, what facility demand designed much is toll-gate and median strip, and which has high design pliability currently but demands much design in the questionnaire are rest area and soundproofing walls. And the facility which needs change of its feature and material are toll-gate and rest area, and that of color are soundproofing walls, median strip and toll-gate.

And the result which compares present condition of facility, questionnaire and present condition of overseas expressway for finding the direction of design is that the facility which needs design pliability are toll-gate, bridge and soundproofing walls. The facility which needs various design in Korea are resting area and median strip, and place of business, bridge and impact absorption facility can design variously in abroad but a low need in Korea.

The result of research about importance of landscape feature of an express highway facilities, the high of that is in order of toll-gate, resting area, soundproofing walls and median strip in Korea, and toll-gate, soundproofing walls, place of business, resting area and impact absorption facility in abroad.

The facilities which have highest importance of landscape feature from the inside and outside of the country are toll-gate, soundproofing walls and resting area, and the facility needed the improvement urgently is toll-gate. When comparing the inside and the outside of the country, the facilities that have a big viewable effect are bridge, median strip, cutting slope, sight line induction facility, emergency liaison establishment, and so on.

<Chart8.Comparison of the present of express highway facility's design>

facilities	system				status				question				abroad			
	form	material	color	total	form	material	color	total	form	material	color	total	form	material	color	total
Toll Gate	3	2.5	3	8.5	1	1	1	3	9	9	7	26	3	3	3	9
place of business	2.5	3	3	8.5	10	5	10	25	2	2	2	6	2	3	3	8
resting place	3	3	3	9	10	10	10	30	7	8	4	19	3	3	1	7
bridge	2	1.5	3	6.5	4	2	6	12	2	1	2	5	3	2	3	8
tunnel	1	1	3	5	1	5	10	16	2	1	2	5	2	1	2	5
cutting slope	1	2	2.5	5.5	2	3	2	7	2	1	2	5	1	3	2	6
soundproofing walls	2	1.5	2.5	6	4	6	10	20	5	2	9	16	3	3	3	9
median strip	1	1	3	5	3	2	5	10	5	1	8	14	1	3	1	5
pavement of a road	1	1	1	3	1	1	1	3					1	1	1	3
road sign	1	1	1	3	4	1	1	6	2	1	3	6	2	1	1	4
lighting	1.5	1.5	2	5	1	1	1	3	2	1	1	4	2	1	1	4
bus stop	2.5	2.5	3	8	3	3	2	8					1	1	1	3
emergency liaison establishment	2	2	1.5	5.5	2	1	2	5					3	1	2	6
the road surface mark	1	1	1	3	1	1	1	3					2	1	1	4
high technology operation facility	1	1.5	2	4.5	2	1	1	4					3	1	2	6
protection a fence	1	1	2.5	4.5	1	1	2	4	2	1	1	4	1	1	2	4
impact absorption facility	2	1	1	4	3	1	2	6					3	2	3	8
sight line induction facility	1	1.5	1	3.5	3	1	2	6					3	1	2	6
slip control facility	1	1	1.5	3.5	2	2	3	7					1	1	1	3
Falling rocks prevention	1.5	1	2.5	5	3	2	2	7					1	1	2	4
temporary facilities	2.5	2.5	2.5	7.5	2	2	2	6					1	1	2	4

CONCLUSION

The objective of this research is understanding of Importance of landscape feature of an express highway facilities by deducing each facilities which have high pliability of design from the legal standard of facility design, the design standard of facility, the analysis of present condition of facility design, the questionnaire to the user of expressway and the research about the present of facility design in overseas express highway

- 1) The objects for research are 21 types of local express highway's facility as follows
bridge, tunnel, pavement of a road, median strip, toll-gate, place of business, resting area, soundproofing walls, cutting slope, bus stop, emergency parking area,

emergency liaison establishment, traffic safety sign, a road sign, a road surface mark, a road lightning sign, speed sensor, an advanced operation facilities, a protection fence, impact absorption facility, sight line induction facility, lighting facilities, slip control facility, facilities for a falling rock prevention, and temporary facilities, the routes for research are 26 expressway routes.

- 2) The research method is to grade the 24 types of facility into three ratings; high (1), medium (2), low (3), by feature, material, and color through the numbers of legal standards and intensity. The higher the score the more flexible the design can be and the lower less flexible design it can have.
- 3) The outcome by legal standard of facility, the facility which has high pliability of design are toll-gates, place of business, resting area, bus stops, but the pavement of a road, road sign, the road surface mark, and a sight line induction facility has low design pliability.
- 4) The outcome by design standard is toll-gates, place of business, resting area, bridge, tunnel, cutting slope, soundproofing walls, bus stops, the road surface mark, and a sight line induction facility have design flexible but the pavement of a road, road signs, emergency liaison establishment, slip prevention installation, and a temporary facility have low design flexible.
- 5) The outcome by present design condition is resting area, place of business, soundproofing walls, tunnel, bridge, median strip have design flexible but toll Gate, pavement of a road, lighting system, road surface mark, advanced operation facility, protection fence have rarely design flexible.
- 6) The result of questionnaire is in order of toll-gate, rest area, soundproofing walls, median strip needed the change of design, but lighting facility is not needed.
- 7) The outcome by present design condition is in order of toll Gate, pavement of a road, place of business, bridge, impact absorption facility have design flexible. But the facility have rarely design flexible is in order of pavement of a road, bus stop, slip control facility.
- 8) The result of research about importance of landscape feature of an express highway facilities, the facility which has high importance is in order of toll-gate, resting area, soundproofing walls and median strip in Korea, and toll-gate, soundproofing walls, place of business, resting area and impact absorption facility in abroad. The facilities which have highest importance of landscape feature from the inside and outside of the country are toll-gate, soundproofing walls and resting area, and the facility needed the improvement urgently is toll-gate, and the facilities that have a big

viewable effect when comparing the inside and the outside of the country are bridge, median strip, cutting slope, sight line induction facility, emergency liaison establishment, and etc.

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